

CLAIMS

1) A method for determining reflection travel times of seismic events picked on 3D records of seismic data corresponding to signals picked up by seismic receivers distributed along an acquisition line in response to the emission in the subsoil of waves from source points, this data having been previously converted to cylindrical wave data and interpreted, characterized in that it comprises the following stages :

a) defining a slowness vector (\vec{p}) whose component (p_x) in a direction parallel to the acquisition line defines the slope of the cylindrical wave ;

b) for a seismic receiver situated at abscissa (x_R) on the acquisition line, seeking abscissa (ξ) of the source point on the acquisition line such that a ray starting from the seismic receiver and reflecting on a picked event emerges at the source point, with a slowness vector (\vec{p}) whose component in the direction of the acquisition line is ($-p_x$) ;

c) determining a travel time ($t^*(x_R)$) by adding to the value of the travel time along said ray a time equal to the product of the slope of the cylindrical wave by the abscissa of the source point ;

d) repeating stages b) and c) for all the positions of the receivers for which a demigration result is wanted ; and

e) repeating stages a) to d) for all the values taken by parameter (p_x) for which an event has been picked in the corresponding migrated data.

2) A method for determining reflection travel times of seismic events picked on 3D records of seismic data corresponding to signals picked up by seismic receivers distributed along several acquisition lines in response to the emission in the subsoil of

waves from one or more source points, this data having been previously converted to a superposition of migrated cylindrical wave data and interpreted, characterized in that it comprises the following stages :

- a) defining a slowness vector (\vec{p}) whose component (p_x) in a direction parallel to the acquisition lines defines the slope of the cylindrical waves associated with the various acquisition lines ;
- b) for a given seismic receiver situated at an abscissa (x_R) on an acquisition line, seeking abscissa (ξ) of a source point on the acquisition line such that a ray starting from the seismic receiver and reflecting on a picked event emerges at said source point, with a slowness vector (\vec{p}) whose component in the direction of the acquisition line is ($-p_x$) ;
- c) determining a travel time ($t^e(x_R)$) by adding to the value of the travel time along said ray a time equal to the product of the slope of the cylindrical wave by the abscissa of the source point ;
- d) repeating stages b) and c) for all the positions of the receivers for which a demigration result is wanted ;
- e) repeating stages a) to d) for all the acquisition lines for which a demigration result is wanted,
- f) repeating stages a) to e) for all the values taken by parameter (p_x) for which an event has been picked in the corresponding migrated data.

- 3) A method as claimed in any one of claims 1 or 2, characterized in that the travel times associated with the cylindrical wave events are used to implement a cylindrical-wave reflection tomography technique and to calculate a velocity distribution in the environment.

4) A method as claimed in any one of claims 1 or 2, characterized in that the travel times associated with the cylindrical wave events are converted to travel times associated with shotpoint events, by exploiting correspondences between the cylindrical wave data and the shotpoint data.

5) A method as claimed in claim 4, characterized in that, the seismic data being organized by acquisition lines, the synthesized shot travel times are converted to travel times associated with source-receiver pairs, this conversion being carried out by extrapolation, in the direction of the acquisition lines, of the travel time synthesized for the source-receiver pair that is the closest to the source-receiver pair of the acquisition device for which information on the travel time is wanted.

6) A method as claimed in claim 4, characterized in that, the seismic data being constant-azimuth data, the synthesized shot travel times are converted to travel times associated with the source-receiver pairs, this conversion being carried out by means of a double extrapolation, the first one in the direction defined by the azimuth, the second in the direction orthogonal to the previous direction.

7) Application of the method as claimed in any one of claims 4 to 6 for determining the velocity model by applying, for example, a reflection tomography to the travel times obtained.